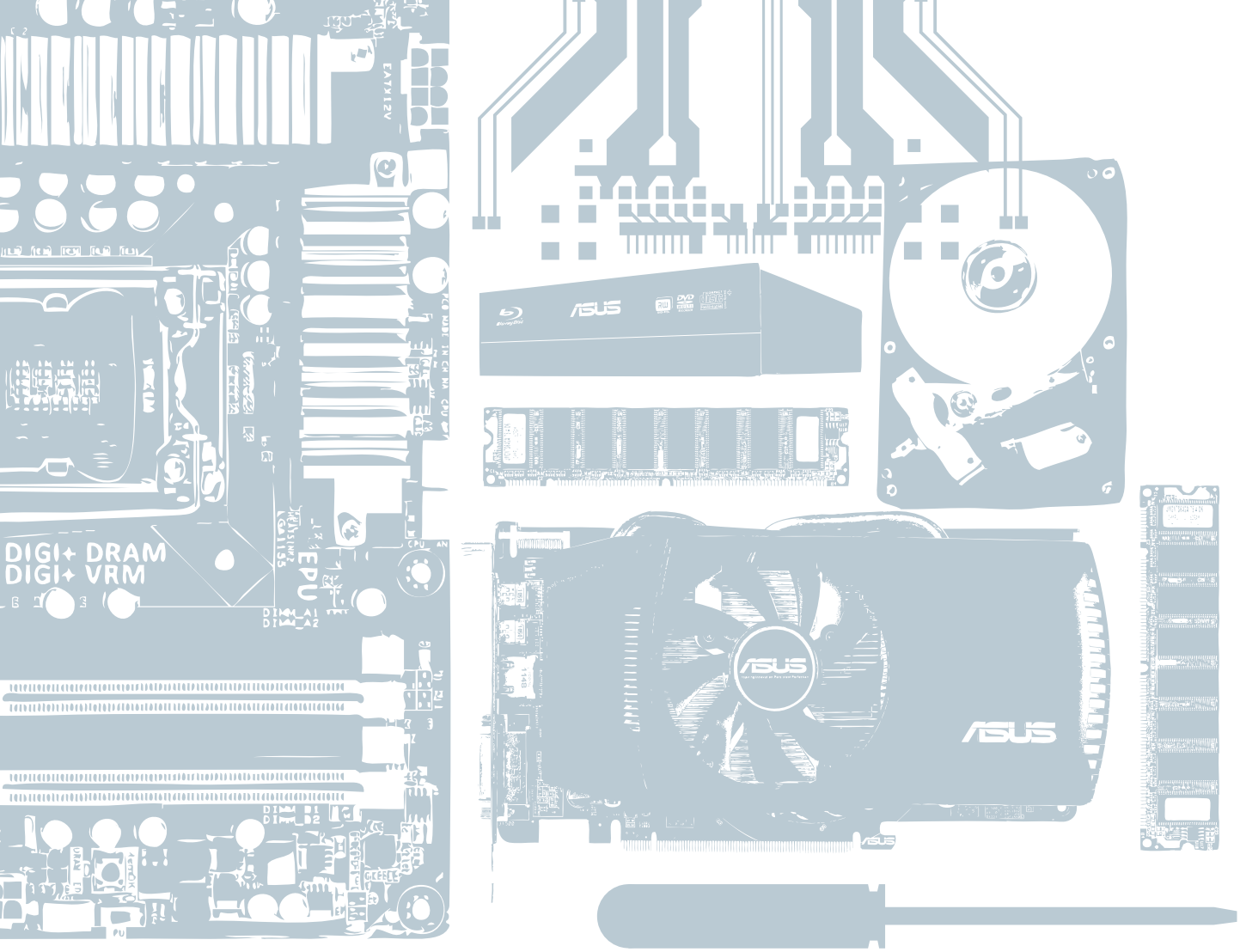

How to build and upgrade your PC

produced in association with ASUS and CoolerMaster

COOLER MASTER®

ASUS®

Building a PC might seem like a daunting task, but in reality, it's simpler than you think.

Introduction

If you can use a screwdriver, you can build and upgrade your own PC. With just a single tool and a little know-how, you can create your own custom-built machine. Do it right and it won't just look and feel unique, it'll be more powerful than an off-the-shelf PC, you'll save yourself some cash, and will gain the satisfaction and insight of a PC pro.

To the untrained eye, PCs might look like a terrifying mess of circuit boards and tiny components which only a well-trained engineer could possibly understand, but in reality most of the complex stuff is done for you. The various parts of a modern PC plug together easily, and it's very hard to assemble them incorrectly.

All you need to do is to work slowly and methodically, and follow a few simple instructions. Which is where this guide comes in. We'll teach you exactly how to select each vital component of a PC, and how they all fit together to make a complete system.

We'll also offer advice to follow if the unlikely happens and things go wrong.

Building a PC is only the beginning, though. There's so much more you can do with it than simply play games or go online. We'll let you in on some overclocker secrets, so you can get more from your system by tuning it for maximum efficiency.

After reading this guide, you'll be able to select the very best parts for building the system you want, the way you want it. Or, if you'd like to learn how to make your current PC go even faster, we'll show you how to upgrade and install new components.

Whether it's maximum performance or top value for money, you'll be able to put together your own tailor-made PC or upgrade your existing one exactly as desired with no hassles!

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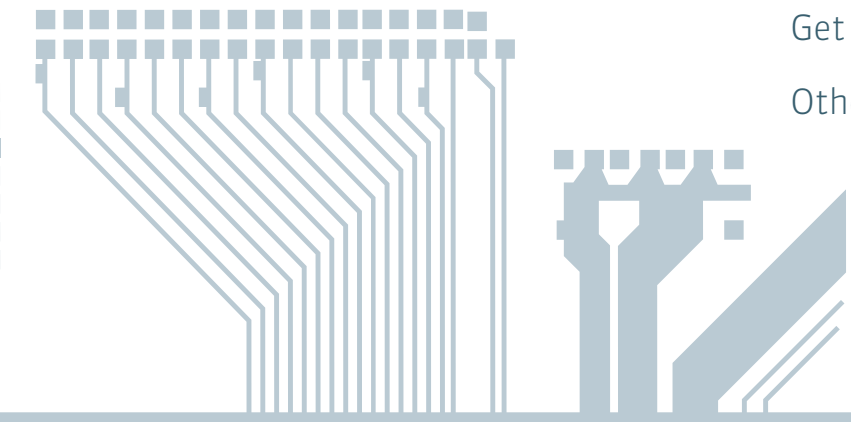
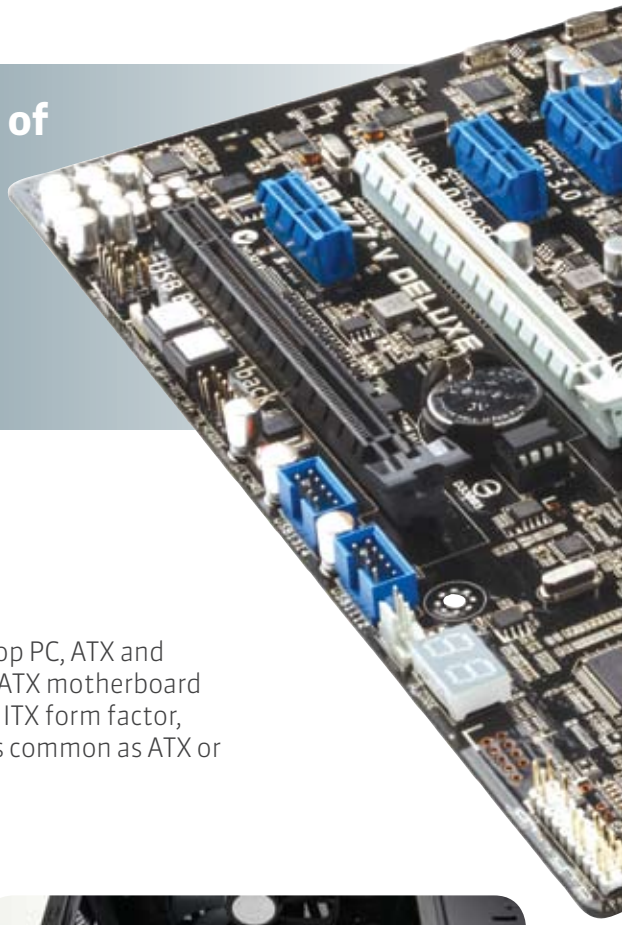


The PC A.B.C...

Your PC is a highly modular machine made up of several swappable parts. It's really not all that complex, though. Here's a breakdown of the components to help you make an informed purchasing decision.



Motherboard form factors: ATX/micro ATX

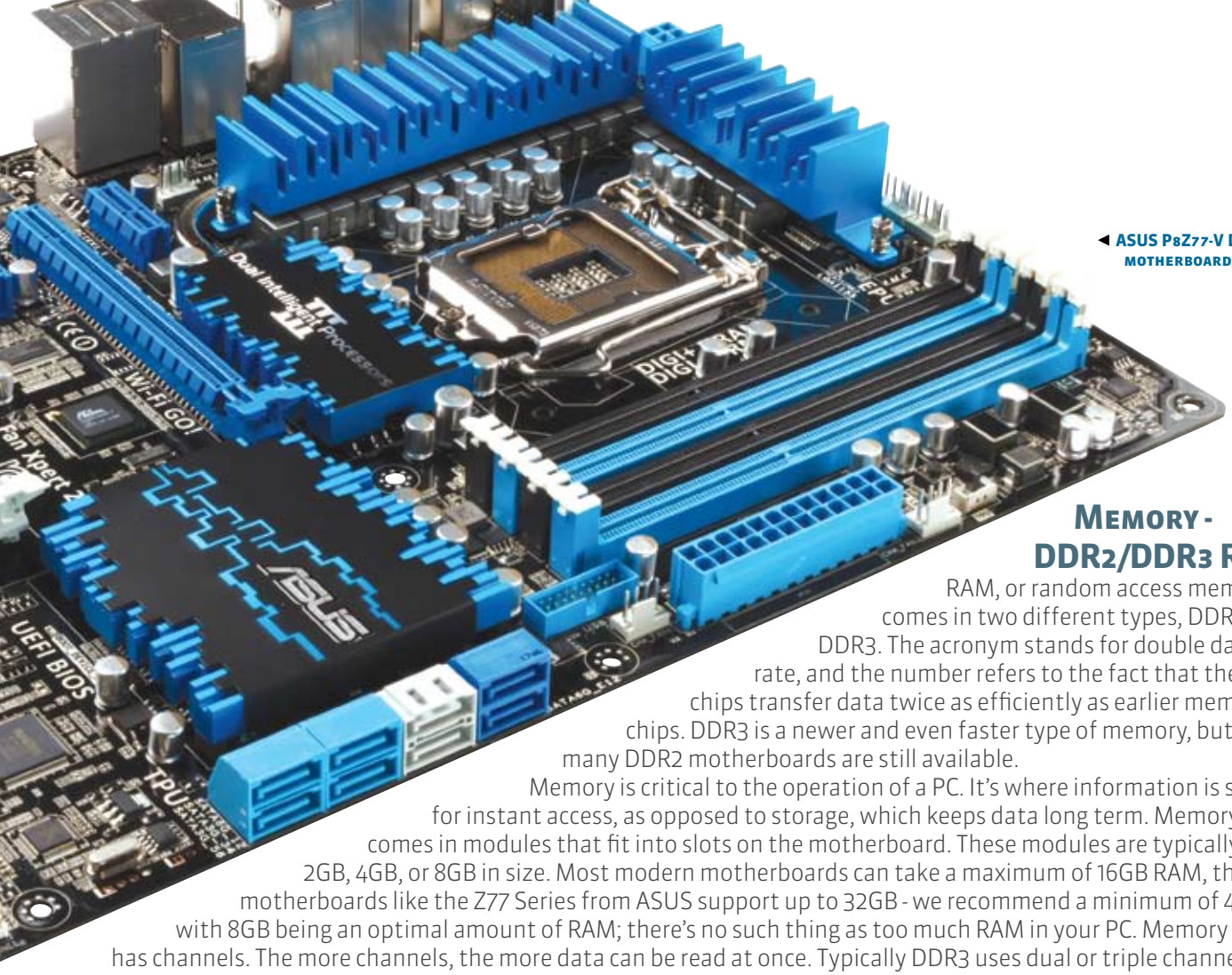
There are two popular standards that dictate the dimensions of a desktop PC, ATX and the smaller micro ATX. Make sure you don't buy a micro ATX case and an ATX motherboard – that'll be like fitting a square peg in a round hole. There is also the mini ITX form factor, typically used in power-efficient home entertainment PCs, but it's not as common as ATX or micro ATX.

Case

Consider what case you're going to build your PC inside. The main technical consideration is buying one suitable for your motherboard (ATX/micro ATX), but there are a lot of other things to take into account. A large, well-built case means you can use quieter fans in and keep air flowing around hot components for improved cooling. Also look for useful features like tool-less fittings, which make assembling your new PC easier. Most cases are made from either aluminum or steel, with steel cases usually being much cheaper than aluminum equivalents. Aluminum is lighter than steel, but doesn't compromise on strength. Noise mitigation is also an issue. Cheaper cases may make your PC noisy due to poor insulation. You may also want to consider a case that comes ready for cable management, because a tidy interior means a better performing PC in the long run.

Central processing unit

The CPU is the chip which forms the brains of your PC. It processes the calculations required for everyday computing tasks like spreadsheets, rendering web pages, running game mechanics, executing spell checkers, and so on. Modern CPUs are defined by both clock speed and number of cores. A dual-core CPU has two processors in one package, while a quad-core CPU has four. Most desktop CPUs have a clock speed of between 2.5GHz and 3GHz, but overclockers have been able to push many variants to an amazing 8GHz with extreme cooling!



◀ ASUS P8Z77-V DELUXE MOTHERBOARD

Memory - DDR2/DDR3 RAM

RAM, or random access memory, comes in two different types, DDR2 and DDR3. The acronym stands for double data rate, and the number refers to the fact that these chips transfer data twice as efficiently as earlier memory chips. DDR3 is a newer and even faster type of memory, but many DDR2 motherboards are still available.

Memory is critical to the operation of a PC. It's where information is stored for instant access, as opposed to storage, which keeps data long term. Memory comes in modules that fit into slots on the motherboard. These modules are typically 2GB, 4GB, or 8GB in size. Most modern motherboards can take a maximum of 16GB RAM, though motherboards like the Z77 Series from ASUS support up to 32GB - we recommend a minimum of 4GB, with 8GB being an optimal amount of RAM; there's no such thing as too much RAM in your PC. Memory also has channels. The more channels, the more data can be read at once. Typically DDR3 uses dual or triple channels. In addition, memory has its own clock speed, just like a CPU. You may see numbers like 1333MHz or 1666MHz next to the module name – that's the memory speed. Many motherboards allow for memory overclocking.

An important point to note is that you can't mix memory types. Make sure all models are the same kind of memory, and also the same speed. To be double sure, you can pick an ASUS motherboard with the MemOK! feature, which can help you verify memory modules.

How should I choose what CPU to buy?

We recommend you select which core number applies to you, then research which frequency fits your budget.

Think of your processor's cores as arms: with six arms it can handle six things at the same time, providing it is given six tasks to do.

Its frequency tells us how fast all the arms are working. Fast arms get any work-load done faster, but they can still only handle one thing each at a time.

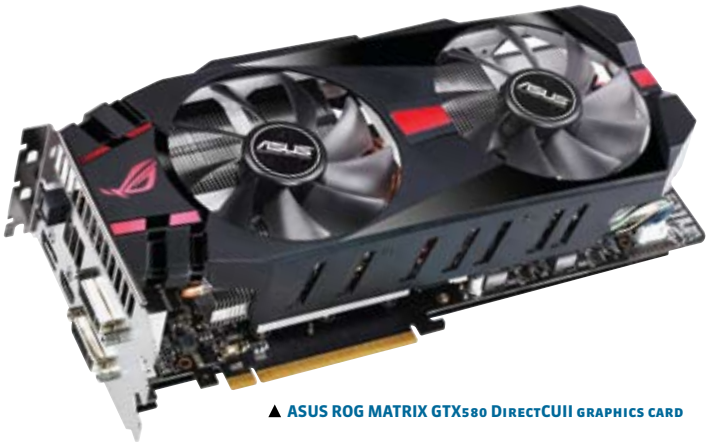
Two(Dual) Core
Normally a dual-core CPU is suitable for those who only require a PC for email, internet, light office work, enjoying video, music and photos, and even casual gaming.

Four(Quad) Core
Those who require quad-core CPUs will be heavy multitaskers, enjoying rich and intense gaming, content creation and editing for video, music or photos.

Six Core
Six core processors provide a level of computing power only needed by those with the heaviest software demands, and professional or scientific applications.

Graphics card

The graphics card is the second most important processor in your system. It's also known as a GPU, or graphics processing unit. If you don't plan on playing games or watching movies, you could get away with the integrated graphics on AMD-based motherboards or the built-in GPU of Intel chipsets such as the Z68 and the newer Z77. If you do want to use your PC for entertainment, look for one of the latest DirectX11 graphics processors, like the ASUS GTX 560 DirectCU II or ASUS HD 7950 DirectCU II TOP, which are powerful enough to play the most demanding games on a display with a 1920x1080 native resolution and are great value for money. If you want the very best, take a look at the ASUS ROG MATRIX 580 graphics card, which is not only one of the fastest available, but one of the most flexible with unique tools for overclocking.



▲ ASUS ROG MATRIX GTX580 DirectCUII graphics card

Heatsink

Every modern CPU requires a heatsink and fan to keep it cool. It will quickly overheat and the PC will shut off without one. Retail boxed CPUs will come with a pre-certified heatsink and fan included in the box, and this is the cheapest way to provide 'good enough' cooling for your CPU of choice. CPUs listed as 'OEM' on retail stores will often be cheaper, but will not come with a heatsink.

In both cases, buying a separate heatsink is the alternative. These vary greatly in size, cooling capacity, noise and cost: with some specifically designed for expert users, or others have specially fitted silent fans to keep the PC as inaudible as possible.

For the purpose of this introductory guide we recommend readers opt for the retail boxed CPUs to make absolutely sure their heatsink will work with their chosen CPU. However, if you are intent on buying an alternative, we recommend contacting the retailer to ask for advice.

Optical drive

You'll probably also need an optical drive. DVD-RW drives are very cheap, but it won't cost you much more to invest in Blu-ray. ASUS Blu-ray combo drives utilize silent operation that's perfect if you plan to use your PC to play HD movies. They also employ energy efficient designs that shut down drive operations when in idle mode, and improve burning performance through intelligent writing strategies that detect the type of data being recorded and the quality of the disc itself to plan the best burn. Optical drives fit into the 5.25" bays in the case.

Motherboard

The motherboard is the single largest component inside your PC, and lies flat against the back of the case. All other parts of the machine plug into the motherboard. Your choice of CPU directly affects the motherboard that's suitable for your system, as you must make sure that the two are compatible. There's much more involved than simply finding one that fits and costs least, though. For a start, you'll need to make sure your motherboard is the right size for your case: mini ITX, micro ATX, or ATX. Then look at what extra features you'd like. For example, many ASUS motherboards have one-click Auto Tuning or the TurboV Processing Unit (TPU), which instantly optimizes your system for extra performance, while for cooling, features like Fan Xpert2 ensure improved control over system fans. The features available on many ASUS motherboards give you complete control over important elements in your system.

Even if you're not planning to overclock your system, buying a cheap motherboard can be a false economy – high quality components are less prone to errors and causing system crashes, and good cooling is essential to prevent data corruption. Motherboards use a BIOS, which is the basic operating system of the PC. These can be difficult to navigate, so you may want to consider models that support mouse-controlled BIOS versions, which use icons just like a Windows program. The ASUS UEFI BIOS is one such offering, and it helps you make full use of other important features, like power delivery. Since the motherboard supervises all the power that goes through your PC, a good power circuit design is vital. ASUS Smart DIGI+ Power Control gives users access to great quality components, alongside digital voltage regulation for more flexible system tuning. On P8Z77 motherboards, this design allows for boosting CPU speeds by as much as 85%, as well as easier memory and integrated graphics tuning, putting you in truly direct control.

Power supply unit

Often overlooked, the PSU is arguably the most important component in your PC! Many technical problems are caused by a faulty power supply, and nothing fits the mantra "buy cheap, buy twice" more than shopping for a PSU. Make sure you get one from a respected brand that has a high enough rating (say 600W or more) to cover all components in your PC. Look for 80 PLUS certification, which ensures a power supply that's at least 80% efficient under load. For instance, if you get a 600W power supply, 80 PLUS means it can provide all 600W to your system while drawing a maximum 720W from the wall. A 50% power efficient supply would give you these 600W for 900W from the wall, thus increasing your energy bills. New technology can help in conserving power and lowering your costs. The Smart DIGI+ architecture found on recent Z77 boards from ASUS can intelligently cut CPU power consumption in half when running low-demand applications.

Storage

The hard drive is where your PC stores programs and files. Slower but cheaper than RAM, the key advantage is that data stored on a hard drive doesn't get deleted when the power is switched off. Music, games, and movies take up a lot of space in storage, so the bigger your hard drive, the better. We recommend a minimum 1TB of hard drive space.

There are two major types of hard drive currently available. Traditional mechanical hard drives are slower but cheaper, and have larger capacities. Solid state drives, or SSDs, have no moving parts, are more energy efficient and quiet, and generally faster. However, they still cost exponentially more at this time. There are so-called hybrid drives, which use a small SSD to accelerate a much bigger hard drive by placing frequently-accessed programs on the faster SSD. ASUS SSD Caching is one such technology, and it significantly boosts overall system performance. You can find it on the ASUS P8Z77 Series of motherboards, for example.

Traditional hard drives fit into 3.5" bays, while newer SSDs are generally 2.5", the size of most notebook PC hard drives. The latter usually come with a bracket to help them fit into a standard 3.5" bay.

RPM stands for revolutions per minute. This shows how fast the platters spin. The faster they spin, the quicker the data access, but a fast hard drive is also noisier and consumes more power. Faster mechanical drives may also wear out sooner due to their more intense operation. Conversely, slower drives are quieter, more energy efficient, and tend to last longer. They're also cheaper!

Sound card

All motherboards come with built-in sound chips, but if you want really high quality you could opt for an add-in soundcard, like one from the ASUS Xonar range, for industry-leading performance. Alternatively, you could look for a motherboard like the ASUS ROG Rampage IV GENE, which has a dedicated SupremeFX III audio solution on the board for professional-grade audio, especially in gaming.

Types of expansion slots

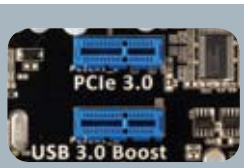
The parts that help your PC grow!

PCI Express 3.0 x16 (PCI-E)

The biggest ports or slots on your motherboard are for PCI Express graphics cards. Like all expansions, it's impossible to place these in the wrong socket or the wrong way round. Your motherboard may have more than one of these, for installing up to four graphics processors. ASUS motherboards routinely support multiple graphics card technologies like NVIDIA SLI and AMD CrossFireX. Even the compact ROG Rampage IV GENE has two PCI Express slots. Also, new ASUS Z77 motherboards feature PCI Express 3.0, which has double the bandwidth of PCI Express 2.0 at 32GB/s. The x16 denotes the number of data lanes available for transmission, with obviously the more lanes available, the faster the theoretical performance of the slot and its connected card.

PCI Express

Smaller PCI Express slots are for less demanding components like sound cards, which don't require as much bandwidth as a graphics card.



PCI

Original PCI connection for older expansion boards, which is still included on motherboards for legacy use. These are smaller than the newer PCI Express x16 slots, and are aligned in the same way below the processor socket.

SATA

These banks of small data ports are for connecting hard drives and optical drives. Since early 2011, ASUS motherboards have supported SATA 6Gb/s speeds for the fastest hard drive performance currently available.

Consider your motherboard's available real estate, especially for PCI Express 2.0/3.0. With many graphics cards requiring three slot-widths to fit, you should plan ahead. A tall graphics card may block adjacent slots like PCI Express 1.0 or PCI, denying you access to a sound card. A long card is very likely to overhang the SATA ports, so do remember to choose a board with right-angled ones.

Around the back

The back of your PC explained

USB

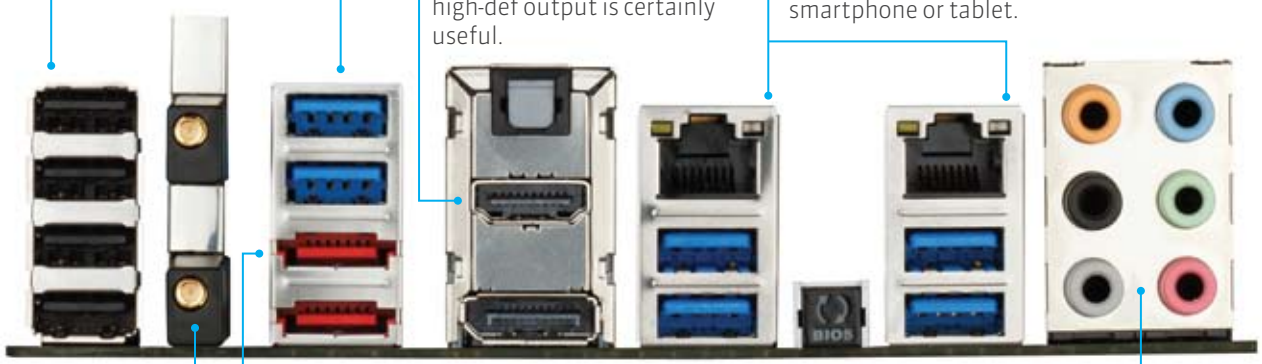
For your keyboard, mouse, printers, external hard drives, and other peripherals. Look out for the newer ASUS motherboards supporting USB 3.0, which is up to ten times faster than USB 2.0. ASUS has also developed USB 3.0 Boost technology to further accelerate performance with new data protocols. USB 3.0 ports are colored blue for easy identification, and the more the merrier: P8Z77 Series models come with at least four USB 3.0 ports.

HDMI Port

The P8Z77 Series comes with integrated graphics, supporting full HD via HDMI. The GPU also complies with DirectX 11 specifications, so this high-def output is certainly useful.

Networking

The main connector here is the RJ-45 plug, or Gigabit Ethernet. It connects to the onboard network controller, which typically supports 10/100/1000Mbps connectivity. ASUS workstation and server motherboards come with dual Intel Ethernet ports, which optimize network performance by relieving the CPU of the need to control online data while under load. Also, ASUS ROG motherboards use technology called GameFirst, which manages network traffic to prioritize bandwidth. That way you can keep gaming online even if heavy downloading occurs in the background. Even newer features include Network iControl for further fine-tuning of network parameters, found on high-end ASUS Z77 motherboards. While most motherboards still lack wireless connectivity capabilities, Z77 products from ASUS include extensive Wi-Fi networking options. ASUS Wi-Fi GO! enables streaming of content from your PC to a TV in the living room, and even lets you control your desktop from a remote device such as a smartphone or tablet.



▶ ASUS P8Z77-V Deluxe motherboard rear I/O

Wi-Fi GO!

Instantly adds convenient wireless to your desktop. The two connectors shown here are for antennas, or aerials, which can also be upgraded later to more powerful variants.

eSATA

A newer type of connection dedicated to external hard drives. Available in powered and non-powered varieties.

DisplayPort

Thanks to advancements in integrated graphics and chipset design, the P8Z77 Series board shown here can drive multiple monitors, hence the DisplayPort output.

Audio

The 5.1-channel or 7.1-channel outputs for your onboard sound and headphones. You may also find a digital audio connector for connecting an optical link cable on some boards.

Input voltage

If you plan to use your PC in different countries, make sure the power supply supports a wide voltage range. Most models are now 100-240V compatible, which makes them safe for use with 110/120 volt and 220 volt standards. Such power supplies have automatic voltage switching mechanisms. Be advised that cheaper products may lack these. If you try to use a power supply with unsupported voltage, chances are the PC simply won't turn on. However, in extreme cases you could face catastrophic failure – not pleasant, so be careful!

Modular power supplies arrive with the cables "on the side". They give you the flexibility of only attaching cables for components you need, reducing case clutter and helping with cable management. But they also require more room in the case, since much of the wiring occurs outside the power supply proper. Non-modular supplies have all the cables already connected, so you don't get to choose which ones go in your case. These increase case clutter and call for more cable management, but also cost less and take up less room.

Tidying up the cables

What connector goes where? Find out with our handy guide

12V auxiliary

Designed to provide extra power to the CPU, this six or eight pin adaptor fits into the slot beside the processor socket.

ATX power

The biggest cable connector in your PC, this large plug fits into a similarly-sized black socket on the motherboard. Like all power cables, it only fits one way.

Fan connectors

These slot over various identical three-pin headers placed around the motherboard, except the four-pin connector for the CPU cooler, which must go over the pins labelled for the CPU fan. Otherwise, ensure the motherboard has at least three more fan headers, as you need these for fans to provide adequate cooling to your PC. Achieving good cooling becomes much easier with features like Fan Xpert 2 on P8Z77 motherboards, which allow you to directly control case and CPU fan speeds both manually and through automatic adjustments.

Front panel connectors

Assorted wires that lead from the buttons, lights, USB, and audio ports on the front of your case, and fit over the appropriate pins at the bottom of the motherboard. They can be quite fiddly to attach, although ASUS motherboards come with a handy riser box that makes putting the right wire on the right pin much easier. ASUS also labels them very clearly for added guidance.

Four-pin Molex

These connectors carry power from the PSU to older peripherals and can be hooked up to fans, as well.

PCI Express power

Not to be confused with the similar-looking CPU power cable. While low-power graphics cards can get by with no connectors, getting power directly from the motherboard, performance graphics cards need at least one six-pin connector. The more performance you want, the more power you need to supply, so really high end cards typically need one six-pin and one eight-pin connector. Make sure your power supply can accommodate these.

SATA cables

These long, flat cables are for transferring data between the hard drives and the motherboard. Try to get a motherboard that has right-angled SATA connectors, so the graphics card doesn't block any of them. All current ASUS motherboards use this design.

SATA power cable

A long, thin connector, each hard drive or optical drive requires one of these power cables plugged in next to the data cable above.

Many modern cases allow you to run power cables between the motherboard plate and the back of the case. Use these clever layouts to keep the inside of your case tidy and to improve cooling.

How to build a PC

Putting together a PC really isn't as hard as you might think. You don't need any special tools, just a steady hand, an hour or two to spare and some patience. It's easy, and after you've done it once, you'll be able to do it much quicker and with greater confidence in future. Just follow our simple guide to get started.

Try to avoid static electricity, as it may damage components. Before handling parts, touch your hands to a metallic surface. Refrain from wearing clothes that might generate more static, like sweaters.

Never force anything. If you feel a part isn't going in smoothly, take a close look at it and figure out the right way – easy, as there's only one. Don't force the issue, as it may cause irreparable damage.

Don't overtighten screws, as that may stress the board and other components. When you feel resistance, stop.

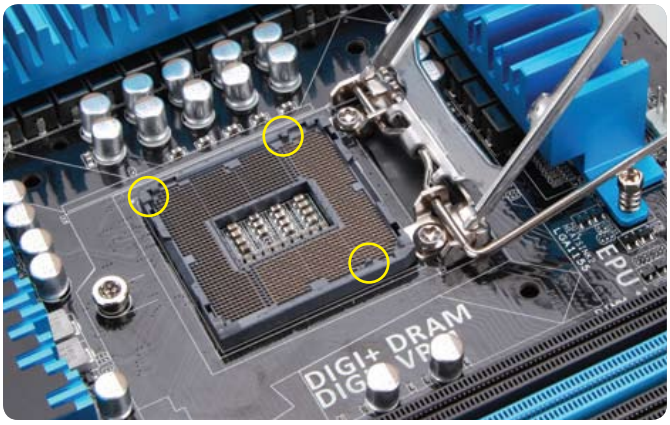
Have a standard-sized Philips screwdriver, as well as a smaller Philips screwdriver ready. Flat-head screwdrivers are useful, but not mandatory.

1 Set up your motherboard

Place the motherboard on a flat, non-conductive surface.

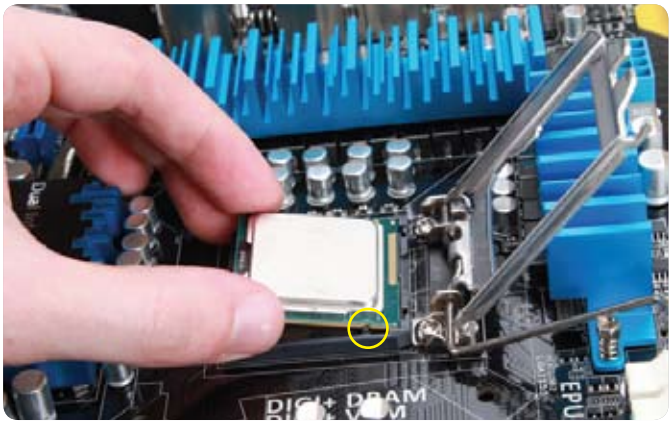
2 Examine the CPU

Your CPU should either have notches cut into either side of the backing, or a pattern of pins projecting from the bottom with a triangle missing in one corner. Compare these to the socket on your motherboard to see which way the CPU fits.



3 Insert CPU

Lift the catch on the CPU socket and raise the hinged cover. It only fits one way round, but may break if you try to force it. Carefully place it in the socket, taking care not to bend any of the pins, and then close the cover and catch.

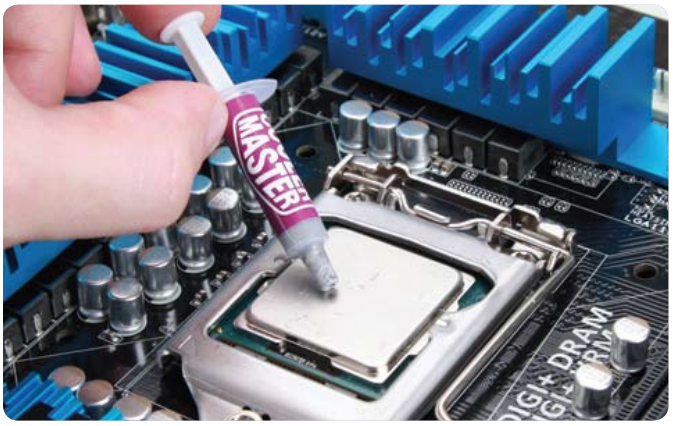


4 Thermal paste

Retail CPUs from both Intel and AMD arrive with their own heatsinks and fans, with thermal paste on the bottom of the heatsink in the area of contact with the CPU. Thermal paste is critical to preventing overheating, as it creates a heat-conductive layer between the CPU and the heatsink, plus acts as a filler to make sure the heatsink touches the CPU with no gaps. Thermal paste usually comes in the form of a small adhesive pad on the underside of your heatsink, or in a small tube.

5 Squeeze out the paste

If your thermal paste is in a tube, you'll need to apply a small pea-sized amount onto the top of the CPU (labelled side) and spread it using something like an old credit card to cover the heatspreader in a thin layer. Make sure the layer is consistent and has no gaps in it. Avoid touching thermal paste of any variety, as this will create imperfections in the layer.



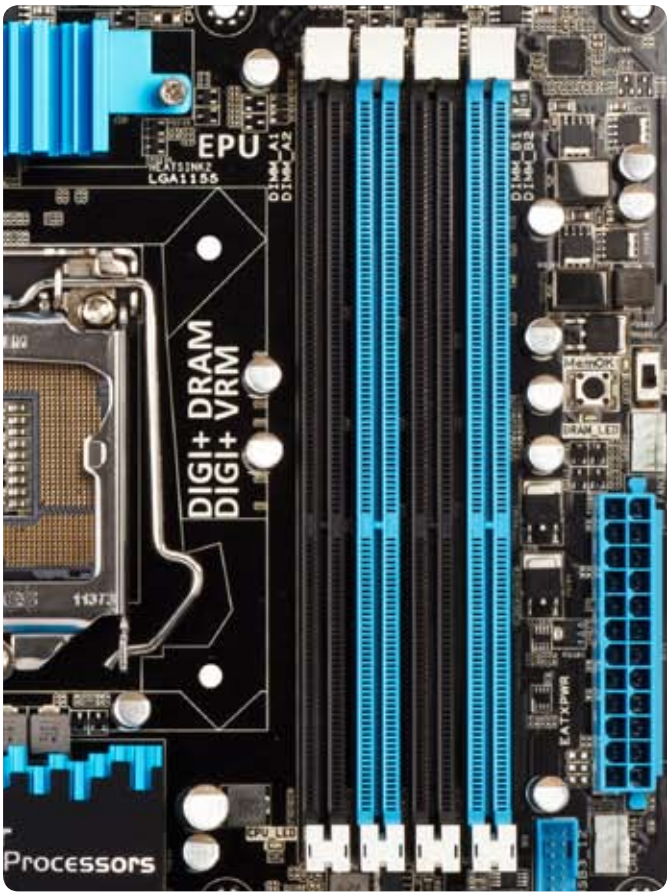
6 Fit the heatsink

Heatsinks ship with full instructions, but they fall into several major categories defined by the processor type. If it's an Intel CPU, the heatsink will have four legs which push into holes on the motherboard. If you purchase the cooler separately, always make sure it fits your CPU and CPU socket. There are exceptions, though. Recent ASUS ROG boards have been using X-Socket adapters that let you carry over LGA 1366 coolers to newer LGA 2011 boards.

For AMD-based machines, you'll need to hook one side of the heatsink bracket over a notch on the CPU socket, and then latch the other end over a matching notch on the other side. Push down on the clip to lock it into position.

7 Install the memory

For best performance, RAM needs to be fitted in two (dual-channel) or three (triple-channel) module sets at a time. The slots on the motherboard are usually color-coded to show which ones need pairing up. Consult your motherboard manual to see which banks to fill first.



Take your time!

The first time you build a PC it should take you a couple of hours. If you rush it and get something wrong, it could take a lot longer to troubleshoot.

Removing thermal paste

Should you need to reapply, dampen cotton pads with isopropyl alcohol, and rub the surface clean. Do not use any cloth, newspaper, napkins or other materials that could fray or fragment, as debris will hamper thermal paste efficiency.

Be careful!

Never force a component into a slot or apply too much pressure with a screwdriver. If you slip and damage the motherboard, it's an expensive mistake to make.

8 Inserting the RAM

The lower edges of RAM sticks are covered in gold connectors and have a small notch cut out. Line this up with a corresponding ledge inside the memory slot to make sure the RAM module is the right way round.

9 Clipping it down

Now open up the clips on either end of the RAM slot. Gently push each stick of memory down until these clips snap back into an upright position and hold the module in place.

10 Open up the case

It's time to open your PC case. Remove the screws that hold the left hand panel to the case, and open up the main compartment. Lay the case on its side on something soft and move any fan cables or extra fastenings out of the way so you have a clear area to work in.

11 The I/O shield

Find the rectangular padded cover with holes cut to fit the rear port that comes in the box with your motherboard. This is also known as the RF shield, and its job is to protect components from electrical interference. In terms of placement, this shield goes on the upper left side of the motherboard, when looking at it from above.

12 Shields up

Make sure the RF shield is the right way up and carefully push it into the matching rectangular hole in the back of your PC case. It should click into position so that it's held firmly in place.

13 Prepare for the motherboard

The motherboard needs to be lifted off the back plate of the PC case to avoid shorting out components. You should have a packet of brass risers in the box which screw into holes in the back of the case and support the motherboard. However, most cases these days ship with ready-made risers already built into the panelling, so these are not a major concern.

14 Where do the risers go?

If you do need to install risers, you'll see six reinforced holes for screwing the motherboard down. Lay the motherboard in the case with the ports showing through the RF shield, and make a note of hole positions. These holes correspond with markings on the motherboard PCB, typically highlighted with gold etchings to provide easy identification.

15 Screw in the risers

Remove the motherboard and look at where the screw holes are. They should line up with six holes in the back of the case. These are where you should fit the brass risers.

16 Insert the motherboard

Now gently put the motherboard back into the case, so that it rests on top of the brass risers and the ports at the back fit through the RF shield. Make sure the reinforced screw holes line up before starting on the next step.

17 Secure it in place

You should have received a box of screws and fittings with your new case. Look for the round-headed screws that fit the dimensions of the brass risers. Be careful not to overtighten them, as you may need to remove the motherboard at a later date.

Use a magnetized screwdriver

These help prevent screws from dropping away, saving you time, frustration, and possible component damage. An errant screw inside a delicate component could cause shorting out or even shredding if it hits moving parts. Magnetized screwdrivers are a smart investment, as they can easily pick up fallen screws even from very tight quarters.

Set aside the spares

You'll have screws and drive bay fittings left over once your PC is built. Keep hold of these for future use in case you want to upgrade or replace faulty items.

Add a second hard drive

Your motherboard probably has six or more SATA ports – so use them! Just remember which drive is where, so you can choose the right one to boot from in your BIOS. If you only have two to three hard drives, you can leave an empty bay between them for improved heat dissipation.

Keep it cool

The key to a stable PC is keeping components cool. Make sure air can flow freely throughout your case and fans are the right way round. They should draw air in at the front, and blow it out the back or the top, depending on your case design. Remember, hot air rises. Ideally, you should have three case fans as a minimum: one front intake, one rear exhaust, and one side intake or exhaust. Fans are available in various sizes – we recommend 120mm or the biggest fan size that your case can support. Install them correctly by observing the direction of the arrow pointing on the fan. This indicates the direction of air flow.

18 Opening up the slots

Below the RF shield, you'll see several metal plates which cover expansion slots for PCI Express parts, like graphics cards. Some cases use screws, others use plastic tool-less fittings to hold components. You simply unscrew or unclip them from the inside to remove them.

19 Room for the GPU

Remove the expansion plate on your case, that lines up with the top PCI Express slot on your motherboard. Many powerful graphics cards now occupy two slots, so you may need to remove the cover plate next to the slot itself. For example, ASUS DirectCU II cards like the HD 7950 DirectCU II TOP require two slots, and massive cards like the ROG Mars II are so tall, they call for three. Also, keep in mind graphics cards are now over 10" long, so prepare adequate space in the case.

20 Inserting the graphics card

Now align the graphics card so the metal backplate fits into the space you just made at the rear of the PC, and the row of gold connectors fits into the PCI Express port. Gently push it in until the retention clip on the right hand side of the port locks into place.

21 Screwing it down

Make sure your graphics card is firmly bolted into place at the back of the case using the screws or clips you removed. If it comes loose, it will put pressure on the PCI Express port, and may damage the motherboard.

22 Fitting the hard drive

All cases are slightly different when it comes to anchoring a hard drive in a 3.5" drive bay. Either the hard drive slides in and needs screwing directly onto the case, or there are two runners to attach to the sides of the drive so that it slips in and out easily. Using the smallest screws that come with the case, either fit the runners onto the drive and slide it into place, or screw it directly into position. Try to mount the hard drive below the graphics card if possible, to give yourself room for upgrades.

23 Opening up the optical drive bays

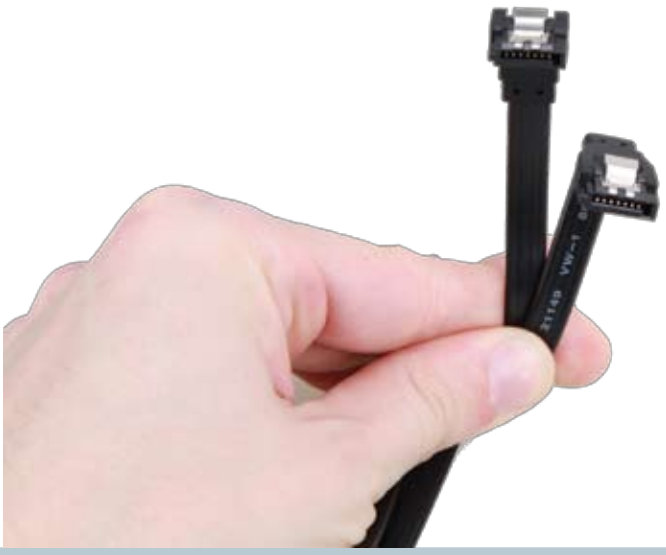
The larger 5.25" drive bays for optical drives are usually found at the top of the case. In order to preserve aesthetics, the front of these bays is closed in a new case. You'll need to open them up before inserting the optical drive, so that the disc tray can slide open once the PC is built. This often means twisting off a metal front plate, but increasingly involves simple snap-in plastic pieces now.

24 Fitting the optical drive

Just like hard drives, DVD or Blu-ray drives are fitted depending on the design of your case. Some simply push through the open hole at the front and are held in place by plastic catches, others may need screwing down to the case struts. Many require runners to be bolted on to the drive before it's pushed into position.

25 Attaching data cables

You should find a set of SATA cables in the motherboard box. Each of your optical drives (and remember, you can add more than one drive if you want) needs one attached to it and the other end plugged into the motherboard.



26 Which SATA port is best?

It doesn't matter which SATA ports on the motherboard you use for which drive, whether it's an optical drive or a hard drive. It's good practice to fill the lower numbered SATA ports first. If you're setting up a RAID array, you may have to use specific ports.

27 Mount the PSU

Now slide your power supply into position above the motherboard. There should be a small rail at the top of the case for it to sit on, which allows it to slide flush to the back of the case. Use four of the largest screws provided with the case to secure the PSU from the rear. Some cases have top-loaded PSUs, while others place them at the bottom. This makes no difference performance-wise.

28 Attach the ATX power supply

Each component needs a separate cable from the PSU to power it. Follow our guide to cable types to see which cable connects to which input. Each of the pins has specially-shaped mouldings, so you can't fit a connector upside down or the wrong way in.

29 Power up the motherboard

First of all, connect the largest 24-pin block of power connectors to the motherboard. Next, attach the smaller, eight pin one to the CPU power supply, this should be somewhere near the CPU socket, usually between the heatsink and RF shield.

30 Connect it all up

Attach SATA power cables to the disk drives, and six-pin plugs to the graphics card. You'll also need to connect any case fans to the motherboard at this stage – including the heatsink fan for the CPU. Some case fans may need to be plugged directly into a four-pin Molex connectors from the PSU.

31 Connect the front panel

While everything so far has been very intuitive, it's time for the only part that's still somewhat tricky - hooking the front panel connectors for the power switch, reset button, power and activity lights, front panel audio, front panel USB, and other connectors that may be available in your case. Make sure to follow the motherboard's hardware installation guide: it has illustrations and color-coded graphs showing which connectors go where. ASUS boards have labels on the board itself to help with this further.

32 Plug in the peripherals

Once you're sure everything is connected correctly, close the case and fasten the side panel with the same screws you took out earlier. Now attach the monitor, keyboard and mouse to the relevant ports around the rear of the PC. Finally, take the three-pin power lead that came with you PSU and connect your new PC to the mains.

33 Keep the cables tidy

One of the biggest problems PCs face is overheating. In order to keep air flowing freely through the case, it's a good idea to tie loose cables neatly out of the way using plastic cable ties or wire twists, then attach them to the vertical struts that run up the case - like the one at the edge of the drive bays.

If you're still unsure which way the connector should plug in, just look for the black wire on one end. That black wire is always the '+' end. So match it with the motherboard '+' label, and the indicators will light up nicelyl

34 Boot to BIOS

You're almost ready to go! There's no operating system on your hard drive yet, though, so you'll need to install Windows or another operating system of your choice. On the first boot, press F2 (or DEL, consult your motherboard manual) and enter the BIOS setup screen. Find a field called "boot device priority", and set this to the name of your optical drive. Remember, ASUS boards with the UEFI BIOS include mouse and icon controls even before you install Windows. This makes creating boot priorities very easy, as you have nice device icons instead of random, hard to remember numerical names to guide you.

35 Get ready to boot!

Now insert the operating system install disc into your optical drive, press F10 to save settings, and reboot. Your operating system should take you through a short, easy setup process before reaching the desktop for the first time.

Congratulations, you've just built your first PC!

How to reset your BIOS?

If you've been playing with the timings of your components or your PC just won't boot, try resetting your BIOS (Basic Input Output System) to factory defaults. You can do this by finding the red CLR_CMOS button on your motherboard. Turn the power off, then press and hold the CLR_CMOS button while pressing the power button.

Many modern motherboards have a failsafe BIOS, which restores from a backup in the event of a terminal crash. Consult your manual if you need to do this. Or get an ASUS board: pretty much all of them have a convenient reset button right on the board itself.

Troubleshooting

If your PC won't boot, your motherboard will either emit a series of beeps or display a combination of letters and numbers on an LCD panel. These should tell you at which point the boot has failed, for example at the memory or processor test, and will give a clue as to which component might be faulty.

Before you do any troubleshooting, make sure all your cables are properly connected. If there's still a problem try unseating and reseating components like the graphics cards and memory. If the problem seems very serious, unplug everything apart from the processor, memory and graphics card and see if you can get to the first boot screen – if you can't, it may be a fault with the motherboard. Try restoring the BIOS from a backup if possible.

When you reseat components, remember to try different slots, and then reboot. At times a faulty slot may be the culprit.

Get started with overclocking

The chances are that your CPU is capable of running at a much higher clock speeds than the one advertised. ASUS motherboards with DIGI+ power delivery make tuning voltages easy, and higher voltages mean faster CPUs and memory. Here's a guide to get you started with overclocking:

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rog.asus.com

1 The BIOS

The most basic way to overclock is from the BIOS setup screen. You can get here by pressing the DEL key as soon as your PC starts to boot. Remember, there is a small possibility that you can damage components by changing BIOS settings. In general, be mindful of component tolerances when overclocking. Recent ASUS motherboards make all that much easier, shipping with UEFI BIOS, which really changes things up. Instead of text-heavy and rather clunky menus that are hard to get used to, it employs an intuitive graphical user interface, much like a major operating system, allowing smooth mouse input. As you can see in these screenshots, the icons are clear and prominent for quick adjustments to timings, frequencies, and boot priorities. All can be done with a few simple clicks, as designers went to considerable lengths to ensure a BIOS experience as approachable as possible.

2 Resetting to default

If at any point while you try to overclock your PC doesn't boot, ASUS motherboards can restart the system at a safe setting for recovery. If you run into problems, clear the CMOS to default using the jumper on your motherboard or the special button on the board.

3 Taking it further

You can set target speeds for the CPU and memory with ROG Connect features on ASUS ROG boards or the Turbo Processing Unit and Auto Tuning suites on other ASUS models. Of course, you can later begin experimenting with really deep modifications, such as installing liquid cooling systems. For that, ASUS has the Subzero Sense feature on ASUS ROG boards, which can detect literally cryogenic temperatures.

4 Getting hands on

There's only so far a motherboard can go by itself, of course, as it always operates within a safe level. You may be able to get more performance from your parts by manually adjusting settings to even higher levels. For an Intel Core i5 or i7 board, the first settings you should look for are CPU ratio setting and base clock frequency. These are made more flexible thanks to the inclusion of ASUS DIGI+ and Extreme Engine Digi+ II power delivery designs.

5 Balance

The trick to overclocking is to keep things balanced. A CPU takes its clock speed as a multiple of the base motherboard speed – Base Clock frequency – which is usually 100MHz. Most CPUs have a locked upper limit to this mulipler but Intel's Core i7 K Series CPUs are unlocked and will deliver the best overclocking results. Changing the Base Clock also increases the CPU frequency, but increases the memory speed as well and could be a cause of system instability – we recommend using a K series chip and overclocking using the multiplier instead.

6 Increasing the charge

For extreme overclocking, you need a high spec CPU cooler. You may also need to increase the voltage supplied to components like the CPU and memory so they have enough power to run as fast as you want. Read up on the art of overclocking at the Republic of Gamers website, rog.asus.com, before you try.

Advanced overclocking with ROG Connect

Some ASUS ROG high end motherboards come with a unique external overclocking feature. Simply plug your notebook PC into the ROG Connect USB port and you can take control of your PC's BIOS in real time while also freeing up valuable CPU resources for maximum efficiency.

Overclocking graphics?

Got your CPU running at high speed? Why not try overclocking your graphics card for even more performance? You can increase the clock speeds and voltages of your graphics card using the NVIDIA or AMD control panels built into the drivers, but ASUS graphics cards often feature GPU Tweak for complete and user-friendly graphics card tuning. More DIY-minded users can also consider using the VGA Hotwire feature available on the ROG Rampage IV Extreme, which allows for direct overvolting of the graphics card for more hardware-level results. It does call for soldering work, so only more seasoned users should attempt this. The Rampage IV Extreme also ships with a bundled peripheral called the OC Key. It lets you tune your PC by simply connecting it to the DVI port on your graphics card, which then brings up an on-screen display where you can change performance values, all in real time. Similar to CPUs, graphics cards can be overclocked and overvolted to increase their GPU core clocks and memory clocks.

▲ ROG OC Key

Other things you'll need...

Getting the best gear

◄ ROG GX900

▲ VG278H LED Display

▼ Wireless W4000 keyboard

Display

Size isn't everything. A high quality 22" monitor, with high color rendition, sharp text, bright backlighting and fast refresh rate is far better than a 24" panel that has a blue colorcast and blurs horribly when something moves too quickly. Look for extra features like ASUS Splendid that improve color balance for gaming, movies, photography, or desktop work at the press of a button. For the ultimate gaming experience, ASUS VG Series displays with NVIDIA® 3D Vision 2™ and 3D LightBoost™ technologies bring games to life in clear and smooth 3D.

Keyboard

There are lots of different keyboards available, some with unusual layouts, ergonomic designs, extra keys for media playback, or gaming and USB extensions built-in. The important thing is to make sure that you have a comfortable keyboard. It might look nice, but if it hurts your arms after half an hour, it's no good. Look for keys which are firm and responsive that will last a long time no matter how much you type or smash at them while playing games.

Mouse

Just like the keyboard, if you can try a mouse before you buy it will save you pain later. Comfort is subjective – one person might find a mouse very comfortable, while for someone else it can make their arms ache in minutes. Large, round mice tend to be better for people who grip their controller fully, while low, flat ones are better if you tend to just guide your controller with your fingertips. Mice designed for notebook PCs are smaller and not really well-suited to gaming or professional graphics work. For those applications, we recommend the ASUS ROG GX900 mouse, with its rather impressive 4000dpi resolution, ergonomic grip, tangle-free wire management, and gold plated connectors.

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